

## RESEARCH PAPER

## The economic burden of smoking in California

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**Objective:** To develop estimates of the direct and indirect costs of smoking for California in 1999.

**Methods:** A prevalence based approach was used to estimate the annual costs of smoking. Econometric models were used to estimate the smoking attributable fraction (SAF) for direct costs (hospitalisations, ambulatory care, prescription drugs, home health care, and nursing home services) and indirect costs due to lost productivity from smoking related illness. The models controlled for socioeconomic factors and other risk behaviours. Epidemiological methods were used to estimate the SAF for indirect costs due to lost productivity from premature deaths. The SAFs were applied to total health care expenditures, days lost, and deaths to obtain smoking attributable total costs.

**Results:** In 1999, the total costs of smoking in California were \$15.9 billion, \$475 per resident, and \$3331 per smoker. Direct costs were \$8.6 billion (54% of the total), indirect costs due to lost productivity from illness were \$1.5 billion (10%), and indirect costs due to premature deaths were \$5.7 billion (36%). The cost of smoking was \$9.4 billion for men and \$6.3 billion for women. There were 43 137 deaths attributed to smoking, representing a total of 535 000 years of life lost. The value of life lost per death averaged \$132 000, or 12.4 years.

**Conclusions:** California smoking related costs are high. The cost methodology presented is useful for other states and nations interested in estimating their costs of smoking. Cost estimates can be used to evaluate the level of cigarette taxes and other policies related to smoking.

Cigarette smoking is a major public health problem. It is the leading cause of preventable death in the USA and in California.<sup>1</sup> Each year approximately 440 000 Americans die from cigarette smoking—one out of five deaths.<sup>2</sup> The toll of smoking related deaths in California is similar. More than 43 000 people (25 000 men and 18 000 women) in the state died from smoking related causes in 1999, comprising 19% of all deaths in California. In addition to premature deaths, cigarette smoking also causes illness, disability, and productivity losses.

The health hazards of cigarette smoking have been well documented, beginning with the 1964 landmark report of the Surgeon General of the USA.<sup>3–10</sup> Over the years, this growing scientific knowledge base has contributed to a substantial decline in smoking. In 2002, 23.1% of the adult population 18 years of age and over in the USA smoked cigarettes, down from 41.9% in 1965. However, adult smoking prevalence differed more than twofold across states (from 12.7% in Utah to 32.6% in Kentucky), with a rate of 16.4% in California.<sup>11</sup>

Many tobacco control activities take place at the state or local level. California leads the nation in tobacco control activities, but 4.7 million Californians still smoke. It is essential that legislators and activists have the latest cost data to use as a basis for continued support for tobacco control efforts, as emphasised in the latest Master Plan of the Tobacco Education and Research Oversight Committee.<sup>12</sup> The goal of this study is to present estimates of the direct and indirect costs of smoking for California in 1999.

## METHODS

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## RESULTS

Smoking prevalence rates for California adults aged 18 and older in 1999 are shown in table 1. More men than women smoked: 2.7 million men and 1.9 million women. About 6.2 million additional Californian adults were former smokers,

who may continue to experience the adverse health effects of smoking. Table 1 also contains the smoking attributable fractions (SAFs) for direct costs and indirect costs by sex. Except for the indirect costs of lost productivity due to smoking related illness, the SAFs are substantially smaller for women than for men—11.4% of direct costs for men and 8.0% for women are attributable to smoking. Smoking accounts for 22.2% of deaths for men and 15.8% for women.

## Total costs

The total costs to California of the health effects of smoking in 1999 amounted to \$15.8 billion, equalling \$475 per resident and \$3331 per smoker (table 2). The direct costs represented 54% of the total, indirect lost productivity due to illness was 10%, and indirect lost productivity due to premature death was 36%.

The cost of smoking for men was \$9.4 billion compared to \$6.3 billion for women. However, the comparison differs by type of cost. Women have similar direct health care costs as men. While fewer women smoke, women tend to be heavier users of the health care system in general and they tend to live longer than men. Men and women had nearly equal lost productivity from illness; men had higher earnings, but women missed more days from work on average. Lost productivity from premature death was 3.5 times as great for men as for women because more men die of smoking related illness and men are paid more in the labour market and thus have greater lost earnings. On a per resident basis, the total cost for men was almost 50% higher than for women; on a per smoker basis, costs for men were only 6% higher.

## Direct costs

Direct costs were \$8.6 billion, with almost half of these costs (47%) going for hospital care, 24% for ambulatory care, 15%

**Abbreviations:** CDC, Centers for Disease Control and Prevention; SAF, smoking attributable fraction

**Table 1** Adult population, smoking prevalence, and smoking-attributable fractions of medical expenditures, California, 1999

	Total	Men	Women
Population ('000)	24222	12000	12222
Smoking prevalence:			
Current smokers (%)	18.7	22.1	15.3
Former smokers (%)	25.8	28.9	22.8
Smoking attributable fractions (%):			
Direct cost	9.3	11.4	8.0
Ambulatory	5.2	7.1	4.1
Prescriptions	10.0	13.0	8.3
Hospital	12.0	13.6	10.6
Home health	4.5	6.1	4.0
Nursing home	23.0	25.4	21.8
Indirect lost productivity			
Work loss days	NA	8.0	8.9
Bed disability days	NA	NA	15.5
Premature deaths	NA	22.2	15.8

NA, not available.

for nursing home care, 13% for prescriptions, and 1% for home health services. Smoking attributable costs for men exceeded those for women for hospitalizations and ambulatory care, while costs for women were greater than those for men for nursing home care, prescriptions, and home health care.

### Lost productivity due to illness and premature death

Productivity losses due to smoking related illness in California amounted to \$1.5 billion in 1999, indicating that smokers lost many days from productive activities. Losses amounted to \$276 per male smoker and \$381 per female smoker.

There were 43 137 deaths attributed to smoking, accounting for 18.9% of all deaths in California in 1999. The value of lost productivity from smoking related deaths in 1999 dollars

was \$5.7 billion. The value of life lost per death averaged \$132 000; total years of life lost amounted to 535 000 years or 12.4 years of potential life lost per death.

The leading cause of smoking attributable death was cardiovascular disease, accounting for 17 137 premature deaths. There were 14 290 and 11 290 deaths due to neoplasms and respiratory diseases, respectively. Non-smokers also died as a result of smoking in California, including infants exposed in utero (68 deaths), deaths related to fires caused by cigarettes (64 deaths), and non-smokers exposed to environmental tobacco smoke (4560 deaths).<sup>26</sup>

### DISCUSSION

California has one of the most comprehensive tobacco control programmes in the nation, and the prevalence of smoking has been declining over time. Nonetheless, the health effects

**Table 2** Cost of smoking by type of cost and sex, California, 1999

Type of cost and sex	Amount ('000s)	Distribution (%)	Per resident	Per smoker
Total	\$15759779	100.0	\$475	\$3331
Direct cost	\$8564623	54.3	\$258	\$1810
Hospital	\$4016568	25.5	\$121	\$849
Ambulatory*	\$2060234	13.1	\$62	\$435
Nursing home care	\$1267232	8.0	\$38	\$268
Prescriptions	\$1133432	7.2	\$34	\$240
Home health	\$87157	0.6	\$3	\$18
Indirect lost productivity	\$7195156	45.7	\$217	\$1521
Illness	\$1512210	9.6	\$46	\$320
Premature death†	\$5682946	36.1	\$171	\$1201
Men, Total	\$9418889	100.0	\$568	\$3409
Direct cost	\$4243211	45.1	\$256	\$1536
Hospital	\$2130101	22.6	\$128	\$771
Ambulatory*	\$1076995	11.4	\$65	\$390
Nursing home care	\$472147	5.0	\$28	\$171
Prescriptions	\$538307	5.7	\$32	\$195
Home health	\$25661	0.3	\$2	\$9
Indirect lost productivity	\$5175678	54.9	\$312	\$1873
Illness	\$762098	8.1	\$46	\$276
Premature death†	\$4413579	46.9	\$266	\$1598
Women, total	\$6340890	100.0	\$383	\$3221
Direct cost	\$4321412	68.2	\$261	\$2195
Hospital	\$1886467	29.8	\$114	\$958
Ambulatory*	\$983239	15.5	\$59	\$499
Nursing home care	\$795085	12.5	\$48	\$404
Prescriptions	\$595125	9.4	\$36	\$302
Home health	\$61496	1.0	\$4	\$31
Indirect lost productivity	\$2019478	31.8	\$122	\$1026
Illness	\$750111	11.8	\$45	\$381
Premature death†	\$1269367	20.0	\$77	\$645

Numbers may not add to total due to rounding.

\*Includes physician and other professional services.

†Discounted at 3%.

**Table 3** Smoking cost studies by type of study, California

Study	Study year	Cost (billions)		
		Direct	Indirect	Total
Kaplan and Wright <sup>28</sup>	1985	\$4.8	\$2.3	\$7.1
US DHHS <sup>29</sup>	1985	NA	NA	\$5.8
California Dept of Health Services <sup>30</sup>	1988	NA	NA	\$5.9
Rice and Max <sup>31</sup>	1989	\$2.4	\$5.2*	\$7.6
Max and Rice <sup>32</sup>	1993	\$3.6	\$6.3*	\$10
V Miller <i>et al</i> <sup>4</sup>	1993	\$7.1	NA	NA
L. Miller <i>et al</i> <sup>16</sup>	1993	\$8.7	NA	NA
CDC <sup>33</sup>	1998	\$7.1	NA	NA
Current study	1999	\$8.6	\$7.2†	\$15.8

\*Discounted at 4%.

†Discounted at 3%.

CDC, Centers for Disease Control and Prevention; DHSS, Department of Health and Human Services; NA, not available

of smoking cost Californians \$15.8 billion in 1999. These estimates are conservative for several reasons. We did not take into account costs due to passive smoking, fires caused by cigarettes, non-health sector costs such as transportation to providers, and costs of smoking cessation programmes and other interventions to control smoking. We used the human capital approach in this study rather than contingent valuation,<sup>27</sup> which would yield much higher estimates for values of life.

We used average earnings in our estimates of lost productivity. We acknowledge that smokers tend to have lower than average earnings, but earnings data are not available for California smokers. Had these data been available, our estimates of indirect costs would likely have been slightly lower.

Our estimates of the cost of smoking in California are not the first; table 3 summarises the previous cost estimates made for the state. Studies that included both direct and indirect costs reported totals ranging from \$5.8 billion for 1985 to \$10 billion for 1993.<sup>28–32</sup> Our estimates of total costs for 1999 amount to \$15.8 billion. Our estimate of direct smoking costs amounted to \$8.7 billion which is almost three times the estimate made for 1989<sup>31</sup> and twice that made for 1993.<sup>32</sup> These differences result from the use of different methodology and data sources. The first five studies estimate SAFs using the epidemiological approach for attributable risk. Relative risks for mortality or for healthcare utilisation were used as a proxy for the relative risk of health expenditures. The SAFs in the current study were estimated using models which directly related smoking to health expenditures while controlling for other confounding factors, thus estimating the SAFs directly.

The three other recent studies also used econometric models and produced higher direct cost estimates than the earlier studies. The Centers for Disease Control and Prevention (CDC) study<sup>33</sup> estimated a direct cost of \$7.1 billion for 1998, a 21% difference from ours. Part of the

difference can be attributed to the annual cost increase; the remainder is the difference in methodology. The CDC estimates were based on the published SAF estimates by V Miller and colleagues,<sup>34</sup> in which health expenditures were modelled with a reduced form model. Our study was based on a causal relationship framework developed by L Miller and colleagues,<sup>16</sup> which we believe yields more accurate estimates. The V Miller and L Miller models are compared in detail elsewhere.<sup>35</sup>

Different from L Miller,<sup>16</sup> the current study used more recent data sources. Also, we included only the “biological effect” in the calculation of SAFs while Miller included both the “biological t” and the “mixed effect”. Because 80–90% of the total effect came from the biological component and the biological SAFs were more stable, this refinement improves the methodology. Despite the fact that personal medical care expenditures have increased since 1993, the lower SAFs resulted in our direct cost estimate for 1998 being \$8.6 billion compared to \$8.7 billion for 1993 by L Miller.<sup>16</sup>

Californians not only have lower smoking prevalence than most other states, but current California smokers have lower per capita consumption. This might cause our modelling approach to overestimate costs. However, the needed data on smoking intensity over time were not available to permit a model of the impact of this effect on health expenditures.

Between 1989 and 1999, the first decade of the California Tobacco Control Program, adult smoking prevalence decreased 24% in California compared to 17% in the USA as a whole.<sup>36</sup> It is clear from this and our previous work that there has not been a dramatic reduction in smoking-related costs in the state over this time period. Without the tobacco control programme, smoking related costs would have been even higher. Thus, even a state such as California, with a tobacco control programme that is considered among the strongest in the nation, must remain vigilant in its efforts to maintain hard won reductions in smoking prevalence, and cannot expect cost savings to show up for a number of years.

The question has been raised as to whether smokers are paying for their smoking habits. A related question is whether cigarette taxes are at the appropriate level. From an economic perspective, the tax should be set to cover the external costs of smoking—that is, the costs imposed by smokers on others. While we did not estimate the proportion of costs that are internal versus external, Gruber<sup>37</sup> summarised other studies which found that external health care costs alone probably range from \$1.55 to \$1.85 per pack. In addition, sizeable external losses in workplace productivity have not been estimated.<sup>37</sup> We found that smoking related direct costs per pack of cigarettes were \$6.16, and total direct and indirect costs totalled \$11.34 per pack. Current tax proposals in California are to raise the tax per pack of

### What this paper adds

Much of the research on smoking related costs has been conducted at the national level or did not use the most current accepted methodology for cost estimation. Few studies have developed current estimates at the state or local level; yet this is where many tobacco control activities occur.

This study shows the feasibility of applying the econometric approaches used at the national level to obtain good state estimates. The modelling approach is described and the most current estimates for California are presented.

cigarettes by up to \$1.50, which would seem easily justified by the likely magnitude of the external costs. However, it must also be noted that from an equity perspective, if part of the tobacco tax increase is to be passed on to smokers, the revenues raised should be used to help them quit smoking and obtain health care for smoking related illnesses they may already have.

The public health impact of cigarette smoking in California and in the USA is enormous in terms of the large number of preventable illnesses, premature deaths, and high health care costs and productivity losses. Policymakers must continue to push legislation and ordinances that encourage people to quit or to never take up smoking. The approach presented here is useful for other states, nations, and jurisdictions interested in estimating the costs of smoking.



To view the Methods section, visit the Tobacco Control website—<http://www.tobaccocontrol.com/> supplemental.

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